

REMARKS

Non-elected claims 9-15 have been canceled. Applicant reserves the right to file a Divisional Application directed to the non-elected subject matter.

I. Response to Objection to the Abstract

The Examiner objected to the Abstract of the Disclosure as containing more than 150 words.

The Abstract has been amended to delete the portion beginning with “wherein when the number of monomer components...” at page 53, line 12 of the specification.

Withdrawal of the objection to the Abstract is respectfully requested.

II. Response to Rejection under 35 U.S.C. § 112, second paragraph

Claim 7 stands rejected under 35 U.S.C. § 112, second paragraph. The Examiner considered the term “essentially” to be indefinite.

Claim 7 has been amended to recite that the fluorine-containing polymer... substantially does not contain iodine. Support is found, for example, at page 24, line 20 - page 25, line 2. Therein, the iodine content is defined as being 10 ppm or less.

Withdrawal of the foregoing rejection under 35 U.S.C. § 112, second paragraph is respectfully requested.

III. Response to Art Rejections

(A) Claims 1-6

Claims 1-6 were rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent 5,175,223 to Brinati et al or U.S. Patent 5,994,487 to Enokida et al or U.S. Patent 6,388,033 to Noda et al. The Examiner considered each of Brinati et al, Enokida et al and Noda et al as

disclosing a batchwise polymerization process for making fluoropolymers under reduced temperature and reduced pressure meeting the terms of the rejected claims. In particular, citing specific working examples of each of the references (see paragraph 8 at page 6), the Examiner asserts that the reduced numbers for temperature and pressure in combination with the weight ratio of monomers at least overlap the claimed temperature and pressure calculated from the Peng-Robinson formula.

(B) Claims 7 and 8

Claims 7 and 8 were rejected under 35 U.S.C. § 102(b) as being anticipated by or, in the alternative, under 35 U.S.C. § 103(a) as obvious over Brinati et al, Enokida et al or Noda et al. Because the prior art is said to disclose fluorine-containing polymers of fundamentally the same monomeric composition as defined in present claim 1, the Examiner considered that the same (or similar) fluorine-containing polymer of the prior art would *inherently* exhibit physical properties having a Mooney viscosity and weight average molecular weight/number average molecular weight within the scope of rejected claims 7 and 8.

(C) Applicants' Response

Applicants traverse and respectfully request the Examiner to reconsider for the following reasons.

(1) The present invention

The present invention is characterized in that the process for preparing a fluorine-containing polymer involves

(A) copolymerizing under conditions of reduced temperature of at least 0.95 and reduced pressure of at least 0.80 calculated using the Peng-Robinson formula; and

(B) calculating the most suitable composition weight ratio of additional monomers from monomer components of initial monomer composition and monomer components of the target polymer composition and adding the additional monomers.

(a) Condition (A)

By satisfying condition (A), compression set is improved significantly, in addition to increase of the polymerization rate.

According to the calculation example described at page 14, line 18 to page 15, line 16 of the present specification, the critical temperature and the critical pressure when the composition inside the polymerization vessel is VdF/HFP = 36/64 (% by mol) are calculated by the Peng-Robinson formula using Aspen Plus Ver. 11.1, and critical temperature $T_C = 87.7^\circ\text{C}$ and critical pressure $P_C = 3.05\text{MPa}$. Further, when converted by reduced temperature $T_R = 0.95$ and reduced pressure $P_R = 0.80$, the essential polymerization conditions in this case are polymerization temperature $T = \text{at least } 69.7^\circ\text{C}$ and polymerization pressure $P = \text{at least } 2.44\text{MPa}$.

That is, in order to satisfy condition (A), the temperature which is converted by the lower limit of reduced temperature 0.95 has to be less than the polymerization temperature.

Simultaneously, the pressure which is converted by the lower limit of reduced pressure 0.80 has to be less than the polymerization pressure.

(b) Condition (B)

By satisfying condition (B), a polymer can be obtained, which has little degradation of properties due to post-polymerization, which can be produced by highly productive conditions, and furthermore, which has favorable vulcanization properties. Further, condition (B) can be applied only when unreacted monomers are not discharged from the polymerization vessel. This

is because discharged monomers have to be considered when unreacted monomers are discharged from the polymerization vessel.

(2) Regarding US 5,175,223 (Brinati)

In Examples 1 to 6 of Brinati, processes for preparing fluorine-containing polymer are described. Polymerization temperatures T , temperatures calculated from multiplying critical temperatures T_C calculated using the Peng-Robinson formula by the lower limit of reduced temperature T_R 0.95, polymerization pressures P , pressures calculated from multiplying critical pressures P_C calculated using the Peng-Robinson formula by the lower limit of reduced pressure P_R 0.80 of Examples 1 to 6 of Brinati are described in TABLE 1 below. In TABLE 1, the amount of HFP is 37 % by mol in order that the total amount of VdF, TFE and HFP should be 100 % by mol, though the amount of HFP is described to be 39 % by mol in Example 6 of Brinati.

TABLE 1

	Examples					
	1	2	3	4	5	6
VdF (% by mol)	58	59	56	58.5	57	57.5
TFE (% by mol)	4	5	8	5	4.5	5.5
HFP (% by mol)	38	36	36	36.5	38.5	37
T (°C)	85	85	85	85	85	85
$T_C \times T_R$ (0.95) (°C)	55.9	54.7	54.7	55.0	54.3	55.3
P (bar)	19	19	19	19	19	19
$P_C \times P_R$ (0.80) (bar)	33.0	33.1	33.0	33.1	32.9	33.0

From TABLE 1, it can be seen that in all Examples of Brinati, the pressures calculated from multiplying critical pressures calculated using the Peng-Robinson formula by the lower limit of reduced pressure 0.80 of all Examples of Brinati are more than polymerization pressures.

In other words, according to the calculation example described at page 14, line 18 to page 15, line 16 of the present specification, in Brinati, reduced pressures calculated using the Peng-Robinson formula are less than the lower limit of reduced pressures of the present invention 0.80. In addition, Brinati does not describe condition (A). Therefore, Brinati neither describes nor suggests condition (A). For at least this reason, the present invention is not anticipated nor rendered obvious by Brinati.

(3) Regarding US 5,994,487 (Enokida)

In Examples 1 to 2 and Comparative Examples 1 to 4 of Enokida, processes for preparing fluorine-containing polymer are described. Polymerization temperatures T , temperatures calculated from multiplying critical temperatures T_C calculated using the Peng-Robinson formula by the lower limit of reduced temperature T_R 0.95, polymerization pressures P , pressures calculated from multiplying critical pressures P_C calculated using the Peng-Robinson formula by the lower limit of reduced pressure P_R 0.80 of Examples 1 to 2 and Comparative Examples 1 to 4 of Enokida are described in TABLE 2 below.

TABLE 2

	Examples		Comparative Examples			
	1	2	1	2	3	4
VdF (% by mol)	71	69.6	72	71	68	69.5
TFE (% by mol)	5.5	4.8	6	5	4	8.5
HFP (% by mol)	22	22	22	24	22	22
FMVE (% by mol)	1.5	3.6	-	-	6	-
T (°C)	80	80	80	80	80	80
$T_C \times T_R$ (0.95) (°C)	47.2	49.0	63.3	47.3	50.9	46.0
P (kgf/cm ²)	29	29	29	29	29	29
$P_C \times P_R$ (0.80) (kgf/cm ²)	34.9	35.0	34.9	34.8	35.0	34.7

From TABLE 2, it can be seen that in all Examples and Comparative Examples of Enokida, the pressures calculated from multiplying critical pressures calculated using the Peng-Robinson formula by the lower limit of reduced pressure 0.80 of all Examples of Enokida are more than polymerization pressures. In other words, according to the calculation example described at page 14, line 18 to page 15, line 16 of the present specification, in Enokida, reduced pressures calculated using the Peng-Robinson formula are less than the lower limit of reduced pressures of the present invention 0.80. In addition, Enokida does not describe condition (A). Therefore, Enokida neither describes nor suggests condition (A).

(4) Regarding US 6,388,033 (Noda)

In Noda, excessive unreacted monomers are discharged from the polymerization vessel, in order to maintain the monomer composition in the polymerization system substantially the same as that of the composition of the monomer mixture initially charged. Therefore, condition (B) cannot be applied to Noda, and the invention of Noda is quite different from the present invention. For at least this reason, the present invention is neither anticipated nor rendered obvious over Noda.

Accordingly, withdrawal of the foregoing rejections under 35 U.S.C. § 102(b) and 35 U.S.C. § 103 is respectfully requested.

IV. Conclusion

Withdrawal of all rejections and allowance of claims 1-8 is earnestly solicited.

In the event that the Examiner believes that it may be helpful to advance the prosecution of this application, the Examiner is invited to contact the undersigned at the local Washington, D.C. telephone number indicated below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,

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Date: August 9, 2007